

What is claimed is:

1 1. An RF passive circuit comprising:  
2 a semiconductor substrate;  
3 a spiral inductor which is formed on a main surface  
4 of the semiconductor substrate;  
5 a via-hole which is formed at a position adjacent to  
6 the spiral inductor by applying a metal film on an inside  
7 wall of a hole provided through the semiconductor  
8 substrate;  
9 a dielectric layer which is formed on the metal film;  
10 and  
11 a wiring metal layer which is formed on the dielectric  
12 layer and holds a capacitor between the via-hole;  
13 wherein one end of the spiral inductor extends to be  
14 connected with the wiring metal layer.

1 2. The RF passive circuit of Claim 1,  
2 wherein the spiral inductor has a double layer  
3 structure having an upper wiring metal layer and a lower  
4 wiring metal layer, where at least one of the wiring metal  
5 layers is in a spiral pattern, and where the wiring metal  
6 layers are connected to each other, with a contact hole  
7 therebetween.

1 3. An RF choke used in at least one of a matching circuit  
2 and a bias feeding circuit, both circuits being included  
3 in an RF amplifier, the RF choke comprising:

4 a semiconductor substrate where at least one of the  
5 matching circuit and the bias feeding circuit is  
6 incorporated;

7 a spiral inductor which is formed on a main surface  
8 of the semiconductor substrate;

9 a via-hole which is formed at a position adjacent to  
10 the spiral inductor by applying a metal film on an inside  
11 wall of a hole provided through the semiconductor  
12 substrate;

13 a dielectric layer which is formed on the metal film;  
14 and

15 a wiring metal layer which is formed on the dielectric  
16 layer and holds a capacitor between the via-hole,

17 wherein one end of the spiral inductor extends to be  
18 connected with the wiring metal layer.

1 4. An RF passive circuit comprising:

2 a semiconductor substrate;

3 a spiral inductor which is formed on a main surface  
4 of the semiconductor substrate;

5 a via-hole which is formed at a position adjacent to

6 the spiral inductor by applying a metal film on an inside  
7 wall of a hole provided through the semiconductor  
8 substrate;

9 a first wiring metal layer which is formed on a first  
10 dielectric layer and equivalently forms a first capacity  
11 element between the via-hole; and

12 a second wiring metal layer which is formed on the  
13 first wiring metal layer with a second dielectric layer  
14 therebetween, and equivalently forms a second capacity  
15 element between the first wiring metal layer,

16 wherein the via-hole and the second wiring metal  
17 layer are electrically connected to be able to hold a static  
18 capacity determined by a sum of the first capacity element  
19 and the second capacity element,

20 and wherein one end of the spiral inductor further  
21 extends so as to be electrically connected to the first  
22 wiring metal layer.

1 5. The RF passive circuit of Claim 4,

2 wherein the spiral inductor has a double layer  
3 structure having an upper wiring metal layer and a lower  
4 wiring metal layer, where at least one of the wiring metal  
5 layers is in a spiral pattern, and where the wiring metal  
6 layers are connected to each other, with a contact hole

7 therebetween.

1 6. An RF choke used in at least one of a matching circuit  
2 and a bias feeding circuit, both circuits being included  
3 in an RF amplifier, the RF choke comprising:

4 a semiconductor substrate where at least one of the  
5 matching circuit and the bias feeding circuit is  
6 incorporated;

7 a spiral inductor which is formed on a main surface  
8 of the semiconductor substrate;

9 a via-hole which is formed at a position adjacent to  
10 the spiral inductor by applying a metal film on an inside  
11 wall of a hole provided through the semiconductor  
12 substrate;

13 a first wiring metal layer which is formed on a first  
14 dielectric layer and equivalently forms a first capacity  
15 element between the via-hole; and

16 a second wiring metal layer which is formed on the  
17 first wiring metal layer with a second dielectric layer  
18 therebetween, and equivalently forms a second capacity  
19 element between the first wiring metal layer,

20 wherein the via-hole and the second wiring metal  
21 layer are electrically connected to be able to hold a static  
22 capacity determined by a sum of the first capacity element

23 and the second capacity element,  
24 and wherein one end of the spiral inductor further  
25 extends so as to be electrically connected to the first  
26 wiring metal layer.

1 7. An RF passive circuit comprising:  
2 a semiconductor substrate;  
3 a via-hole which is formed by applying a metal film  
4 on an inside wall of a hole provided through the  
5 semiconductor substrate;  
6 a wiring metal layer which is formed on a main surface  
7 of the semiconductor substrate and is electrically  
8 connected to the via-hole; and  
9 an inductor which is made of a metal film in a spiral  
10 pattern and is formed on the first wiring metal layer with  
11 a dielectric layer therebetween.

1 8. The RF passive circuit of Claim 7,  
2 wherein the wiring metal layer is in the same parallel  
3 pattern as the inductor.

1 9. An RF choke used in at least one of a matching circuit  
2 and a bias feeding circuit, both circuits being included  
3 in an RF amplifier, the RF choke comprising:

4 a semiconductor substrate where at least one of the  
5 matching circuit and the bias feeding circuit is  
6 incorporated;

7 a via-hole which is formed by applying a metal film  
8 on an inside wall of a hole provided through the  
9 semiconductor substrate;

10 a wiring metal layer which is formed on a main surface  
11 of the semiconductor substrate and is electrically  
12 connected to the via-hole; and

13 an inductor which is made of a metal film in a spiral  
14 pattern and is formed on the first wiring metal layer with  
15 a dielectric layer therebetween.

1 10. An RF passive circuit comprising:

2 a semiconductor substrate;

3 a via-hole which is formed by applying a metal film  
4 on an inside wall of a hole provided through the  
5 semiconductor substrate;

6 a dielectric layer which is formed on a main surface  
7 of the semiconductor substrate so as to cover the metal  
8 film; and

9 an inductor which is a spirally-formed metal layer  
10 formed on the dielectric layer, which forms a static  
11 capacity where one part thereof faces the metal film of

12 the via-hole.

1 11. An RF choke used in at least one of a matching circuit  
2 and a bias feeding circuit, both circuits being included  
3 in an RF amplifier, the RF choke comprising:

4 a semiconductor substrate where at least one of the  
5 matching circuit and the bias feeding circuit is  
6 incorporated;

7 a via-hole which is formed by applying a metal film  
8 on an inside wall of a hole provided through the  
9 semiconductor substrate;

10 a dielectric layer which is formed on a main surface  
11 of the semiconductor substrate so as to cover the metal  
12 film; and

13 an inductor which is a spirally-formed metal layer  
14 formed on the dielectric layer, which forms a static  
15 capacity where one part thereof faces the metal film of  
16 the via-hole.

1 12. An RF passive circuit comprising:

2 a semiconductor substrate;

3 a dielectric layer which is formed on a first main  
4 surface of the semiconductor substrate;

5 a via-hole which is formed by applying a metal film

6 on an inside wall of a hole provided through a second main  
7 surface of the semiconductor substrate until the hole  
8 reaches the dielectric layer; and  
9 a metal layer formed on the dielectric layer which  
10 holds a static capacity between the metal film of the  
11 via-hole and the metal layer.

1 13. The RF passive circuit of Claim 12, further  
2 comprising:  
3 a resistance element whose one terminal is  
4 electrically connected to the metal layer, and the other  
5 terminal to the via-hole.

1 14. An RF amplifier comprising:  
2 a semiconductor substrate;  
3 a dielectric layer which is formed on a first main  
4 surface of the semiconductor substrate;  
5 a via-hole which is formed by applying a metal film  
6 on an inside wall of a hole provided through a second main  
7 surface of the semiconductor substrate until the hole  
8 reaches the dielectric layer;  
9 a metal layer formed on the dielectric layer which  
10 holds a static capacity between the metal film of the  
11 via-hole and the metal layer; and

12        a field effective transistor, mounted on the  
13 semiconductor substrate, which has a common gate circuit  
14 having a gate terminal electrically connected to the metal  
15 layer.

1    15.    An RF amplifier comprising:

2        a semiconductor substrate;

3        a dielectric layer which is formed on a first main  
4 surface of the semiconductor substrate;

5        a via-hole which is formed by applying a metal film  
6 on an inside wall of a hole provided through a second main  
7 surface of the semiconductor substrate until the hole  
8 reaches the dielectric layer;

9        a metal layer formed on the dielectric layer which  
10 holds a static capacity between the metal film of the  
11 via-hole and the metal layer; and

12       a bipolar transistor, mounted on the semiconductor  
13 substrate, which has a common base circuit having a base  
14 terminal electrically connected to the metal layer.

1    16.    An RF amplifier comprising:

2        a semiconductor substrate;

3        a dielectric layer which is formed on a first main  
4 surface of the semiconductor substrate;

5        a via-hole which is formed by applying a metal film  
6 on an inside wall of a hole provided through a second main  
7 surface of the semiconductor substrate until the hole  
8 reaches the dielectric layer;

9        a metal layer formed on the dielectric layer which  
10 holds a static capacity between the metal film of the  
11 via-hole and the metal layer;

12       a resistance element whose one terminal is  
13 electrically connected to the via-hole and the other  
14 terminal to the metal layer; and

15       a field effective transistor mounted on the  
16 semiconductor substrate whose source terminal is connected  
17 to the other terminal of the resistance element connected  
18 to the metal layer, so as to form a self bias circuit.

1    17. An RF passive circuit comprising:

2       a semiconductor substrate;

3       a via-hole which is formed by applying a metal film  
4 on an inside wall of a hole provided through the  
5 semiconductor substrate;

6       a dielectric layer which is formed on an inside wall  
7 of the via-hole; and

8       a wiring metal layer formed on the dielectric layer,  
9 which holds a static capacity between the via-hole.

1 18. The RF passive circuit of Claim 17, further  
2 comprising:

3 a resistance element whose one terminal is  
4 electrically connected to the metal film of the via-hole,  
5 and the other terminal to the wiring metal layer.

1 19. An RF amplifier comprising:

2 a semiconductor substrate;

3 a via-hole which is formed by applying a metal film  
4 on an inside wall of a hole provided through the  
5 semiconductor substrate;

6 a dielectric layer which is formed on an inside wall  
7 of the via-hole;

8 a wiring metal layer formed on the dielectric layer,  
9 which holds a static capacity between the via-hole; and

10 a field effective transistor, mounted on the  
11 semiconductor substrate, which has a common gate circuit  
12 having a gate terminal electrically connected to the wiring  
13 metal layer.

1 20. An RF amplifier comprising:

2 a semiconductor substrate;

3 a via-hole which is formed by applying a metal film  
4 on an inside wall of a hole provided through the

5 semiconductor substrate;

6 a dielectric layer which is formed on an inside wall  
7 of the via-hole;

8 a wiring metal layer formed on the dielectric layer,  
9 which holds a static capacity between the via-hole; and

10 a bipolar transistor, mounted on the semiconductor  
11 substrate, which has a common base circuit having a base  
12 terminal electrically connected to the wiring metal layer.

1 21. An RF amplifier comprising:

2 a semiconductor substrate;

3 a via-hole which is formed by applying a metal film  
4 on an inside wall of a hole provided through the  
5 semiconductor substrate;

6 a dielectric layer which is formed on an inside wall  
7 of the via-hole;

8 a wiring metal layer formed on the dielectric layer,  
9 which holds a static capacity between the via-hole;

10 a resistance element whose one terminal is  
11 electrically connected to the metal film of the via-hole  
12 and the other terminal to the metal layer; and

13 a field effective transistor mounted on the  
14 semiconductor substrate whose source terminal is connected  
15 to the other terminal of the resistance element connected

16 to the metal layer, so as to form a self bias circuit.

1 22. An RF passive circuit comprising:

2 a semiconductor substrate;

3 a via-hole which is formed by applying a metal film  
4 on an inside wall of a hole provided through the  
5 semiconductor substrate;

6 a first dielectric layer which is formed on an inside  
7 wall of the via-hole;

8 a first wiring metal layer formed on the first  
9 dielectric layer which equivalently forms a first capacity  
10 element between the via-hole;

11 a second dielectric layer which is formed on the first  
12 wiring metal layer; and

13 a second wiring metal layer formed on the second  
14 dielectric layer which equivalently forms a second  
15 capacity element between the first wiring metal layer,

16 wherein the via-hole and the second wiring metal  
17 layer are electrically connected, and the sum of static  
18 capacity of the first capacity element and the second  
19 capacity element are held between the via-hole and the  
20 first wiring metal layer.

1 23. The RF passive circuit of Claim 22, further

2 comprising:

3 a resistance element whose one terminal is  
4 electrically connected either to the second wiring metal  
5 layer or to the via-hole, and the other terminal to the  
6 first wiring metal layer.

1 24. An RF amplifier comprising:

2 a semiconductor substrate;

3 a via-hole which is formed by applying a metal film  
4 on an inside wall of a hole provided through the  
5 semiconductor substrate;

6 a first dielectric layer which is formed on an inside  
7 wall of the via-hole;

8 a first wiring metal layer formed on the first  
9 dielectric layer which equivalently forms a first capacity  
10 element between the via-hole;

11 a second dielectric layer which is formed on the first  
12 wiring metal layer;

13 a second wiring metal layer formed on the second  
14 dielectric layer which equivalently forms a second  
15 capacity element between the first wiring metal layer,

16 the via-hole and the second wiring metal layer being  
17 electrically connected, and the sum of static capacity of  
18 the first capacity element and the second capacity element

19 being held between the via-hole and the first wiring metal  
20 layer; and

21 a field effective transistor, mounted on the  
22 semiconductor substrate, which has a common gate circuit  
23 having a gate terminal electrically connected to the first  
24 wiring metal layer.

1 25. An RF amplifier comprising:

2 a semiconductor substrate;

3 a via-hole which is formed by applying a metal film  
4 on an inside wall of a hole provided through the  
5 semiconductor substrate;

6 a first dielectric layer which is formed on an inside  
7 wall of the via-hole;

8 a first wiring metal layer formed on the first  
9 dielectric layer which equivalently forms a first capacity  
10 element between the via-hole;

11 a second dielectric layer which is formed on the first  
12 wiring metal layer;

13 a second wiring metal layer formed on the second  
14 dielectric layer which equivalently forms a second  
15 capacity element between the first wiring metal layer,

16 the via-hole and the second wiring metal layer being  
17 electrically connected, and the sum of static capacity of

18 the first capacity element and the second capacity element  
19 being held between the via-hole and the first wiring metal  
20 layer; and

21 a bipolar transistor, mounted on the semiconductor  
22 substrate, which has a common base circuit having a base  
23 terminal electrically connected to the first wiring metal  
24 layer.

1 26. An RF amplifier comprising:

2 a semiconductor substrate;

3 a via-hole which is formed by applying a metal film  
4 on an inside wall of a hole provided through the  
5 semiconductor substrate;

6 a first dielectric layer which is formed on an inside  
7 wall of the via-hole;

8 a first wiring metal layer formed on the first  
9 dielectric layer which equivalently forms a first capacity  
10 element between the via-hole;

11 a second dielectric layer which is formed on the first  
12 wiring metal layer;

13 a second wiring metal layer formed on the second  
14 dielectric layer which equivalently forms a second  
15 capacity element between the first wiring metal layer,

16 the via-hole and the second wiring metal layer being

17 electrically connected, and the sum of static capacity of  
18 the first capacity element and the second capacity element  
19 being held between the via-hole and the first wiring metal  
20 layer;

21 a resistance element whose one terminal is  
22 electrically connected either to the second wiring metal  
23 layer or to the via-hole, and the other terminal to the  
24 first wiring metal layer; and

25 a field effective transistor mounted on the  
26 semiconductor substrate whose source terminal is connected  
27 to the one terminal of the resistance element connected  
28 either to the second wiring metal layer or to the via-hole,  
29 so as to form a self bias circuit.